Water Resources of the Basin and Range Carbonate Aquifer System in White Pine County Nevada, and adjacent areas in Nevada and Utah

BARCAS Study

or

BARCASS

BARCASS

- Present study mandated by Lincoln County Conservation, Recreation, and Development Act of 2004 (short title)
- Funding of $6 million provided by amendments to SNPLMA
- Draft Report – June 1, 2007
- Final Report – December 1, 2007

Lincoln County Land Act

- “(1) IN GENERAL – The Secretary, acting through the United States Geological Survey, the Desert Research Institute, and a designee from the State of Utah shall conduct a study to investigate ground water quantity, quality, and flow characteristics in the deep carbonate and alluvial aquifers of White Pine County, Nevada, and any groundwater basins that are located in White Pine County, Nevada, or Lincoln County, Nevada, and adjacent areas in Utah”.

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Study Team Participants

- United States Geological Survey
  - Water Resources Nevada District
  - Water Resources Utah District
  - Geology Denver
  - Geology Menlo Park
- Desert Research Institute
- Designee from Utah – Utah State Engineers Office

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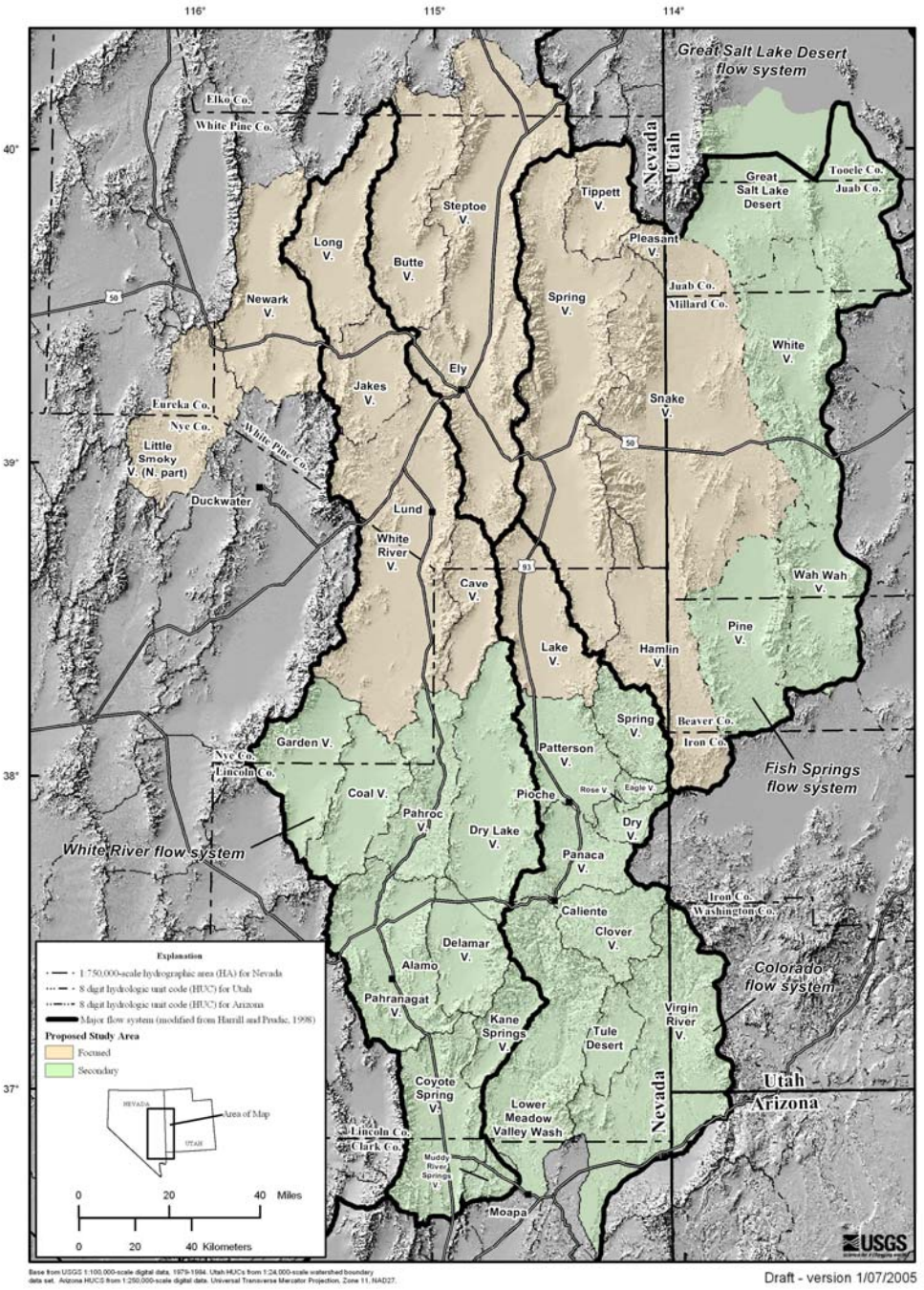
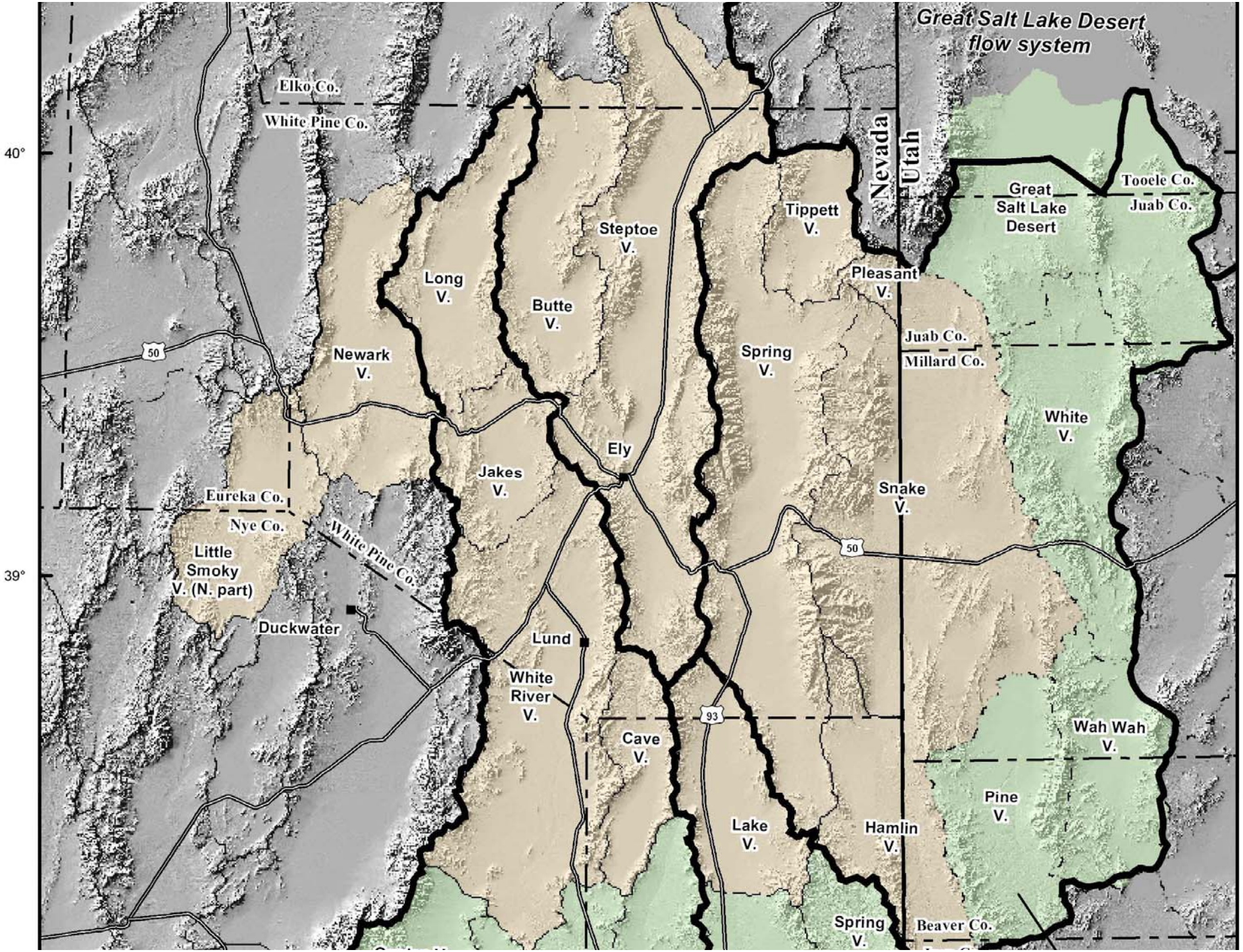
BARCASS Study Area




Great Salt Lake Desert flow system
Elko Co.
White Pine Co.
40°
Nevada
Utah
Great Salt Lake Desert
Tooele Co.
Juab Co.
Tippett V.
Steptoe V.
Long V.
Butte V.
Pleasant V.
Juab Co.
Millard Co.
50
Newark V.
Spring V.
White V.
Ely
Jakes V.
Eureka Co.
Nye Co.
White Pine Co.
Snake V.
50
39°
Little Smoky V. (N. part)
Duckwater
Lund
White River V.
93
Cave V.
Wah Wah V.
Pine V.
Lake V.
Hamlin V.
Spring V.
Beaver Co.

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Lincoln County Land Act

- "The study shall–
  (A) focus on a review of existing data and may include new data;
  (B) determine the approximate volume of water stored in the aquifers in those areas;
  (C) determine the discharge and recharge characteristics of each aquifer system;
  (D) determine the hydrogeologic and other controls that govern the discharge and recharge of each aquifer system; and
  (E) develop maps at consistent scale depicting aquifer systems and the recharge and discharge areas of such systems."

BARCASS Tasks

- (1) Consolidation of information and operation of a unified data collection network
- (2) Determination of the extent, thickness and hydrologic properties of the various aquifer units and estimation of the volume of ground water in storage.
- (3) Delineation of ground-water recharge areas and rates.
- (4) Delineation of ground-water discharge areas and rates.
- (5) Correlation and quantification of water budget components into conceptual regional flow systems.
- (6) Reporting of Results

Scope of Tasks

• (1) Data	660,000
• (2) Geohydrology	1,100,000
• (3) Recharge	250,000
• (4) Discharge	1,670,000
• (5) Conceptual Model	1,290,000
• (6) Reporting	1,030,000

BARCASS Products

- Report to Congress
- Initiate construction of 3-D hydrogeologic framework
- Constrain water-budget estimates for all valleys in study area
- Establish long-term data networks and information delivery systems
- Institutionalize agency relations and public expectations

BARCASS is/will Not

- An Environmental Impact Study
- Produce a calibrated ground-water flow model
- Answer all questions or alleviate all concerns
- Address sustainability concepts.

BARCASS Tasks

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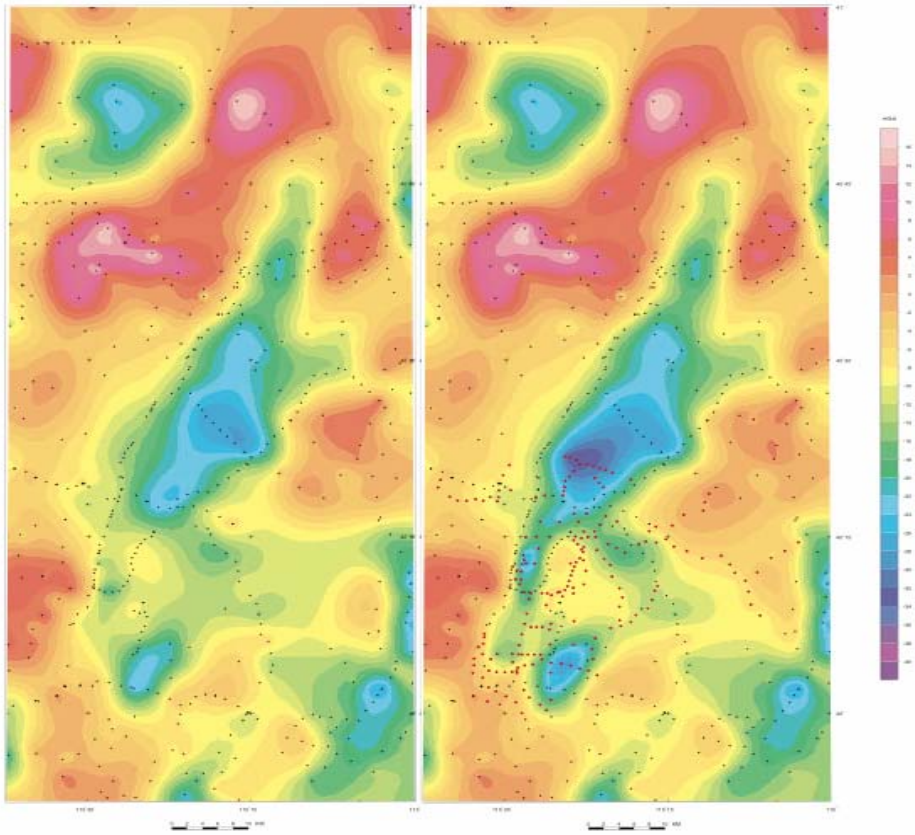
Geohydrology Tasks

- Aquifer Geometry in 3-Dimensions
  - Geophysics (Gravity, Electromagnetic, CSAMT Controlled-source audiofrequency magnetotelluric)

Ruby Valley Isostatic Gravity Map

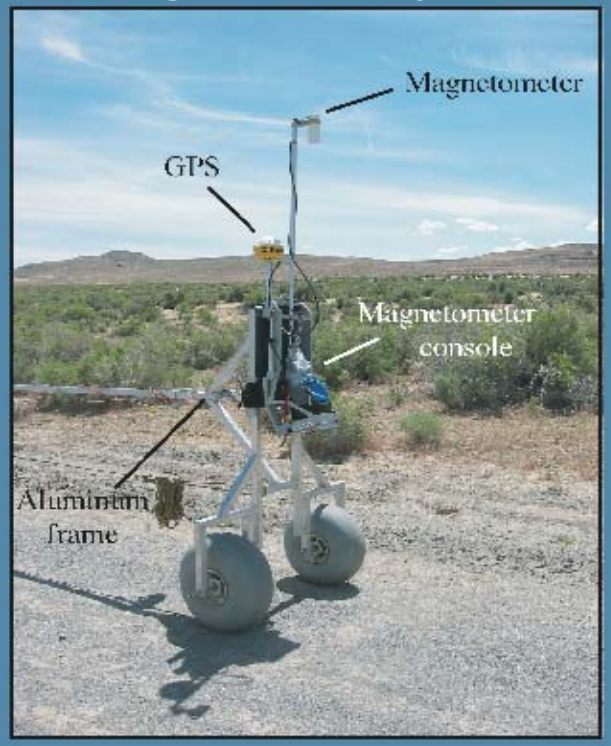
Previous Map Current Map



Geohydrology Tasks

- Aquifer Geometry in 3-Dimensions
  - Geophysics (Gravity, Electromagnetic CSAMT Controlled-source audiofrequency magnetotelluric)
- Aquifer Characteristics
  - Geophysics (Magnetic)
  - Drill Stem Tests

Truck-towed Magnetometer System



Researched, Developed, and Designed by R. Morin, D. Ponce, and J. Glen, USGS, Menlo Park

Geohydrology Tasks

- Aquifer Geometry in 3-Dimensions
  - Geophysics (Gravity, Electromagnetic CSAMT Controlled-source audiofrequency magnetotelluric)
- Aquifer Characteristics
  - Geophysics (Magnetic)
  - Drill Stem Tests
- Geological Controls on Ground-Water Flow
  - Stratigraphic Studies (Facies changes)
  - Geophysics (All)

Recharge Task

- Basin Characterization Model (BMC); monthly water balance model using precipitation, potential ET, bedrock permeability
- Detailed daily rain-fall runoff model (INFILv3) six-layered deterministic model used in selected areas

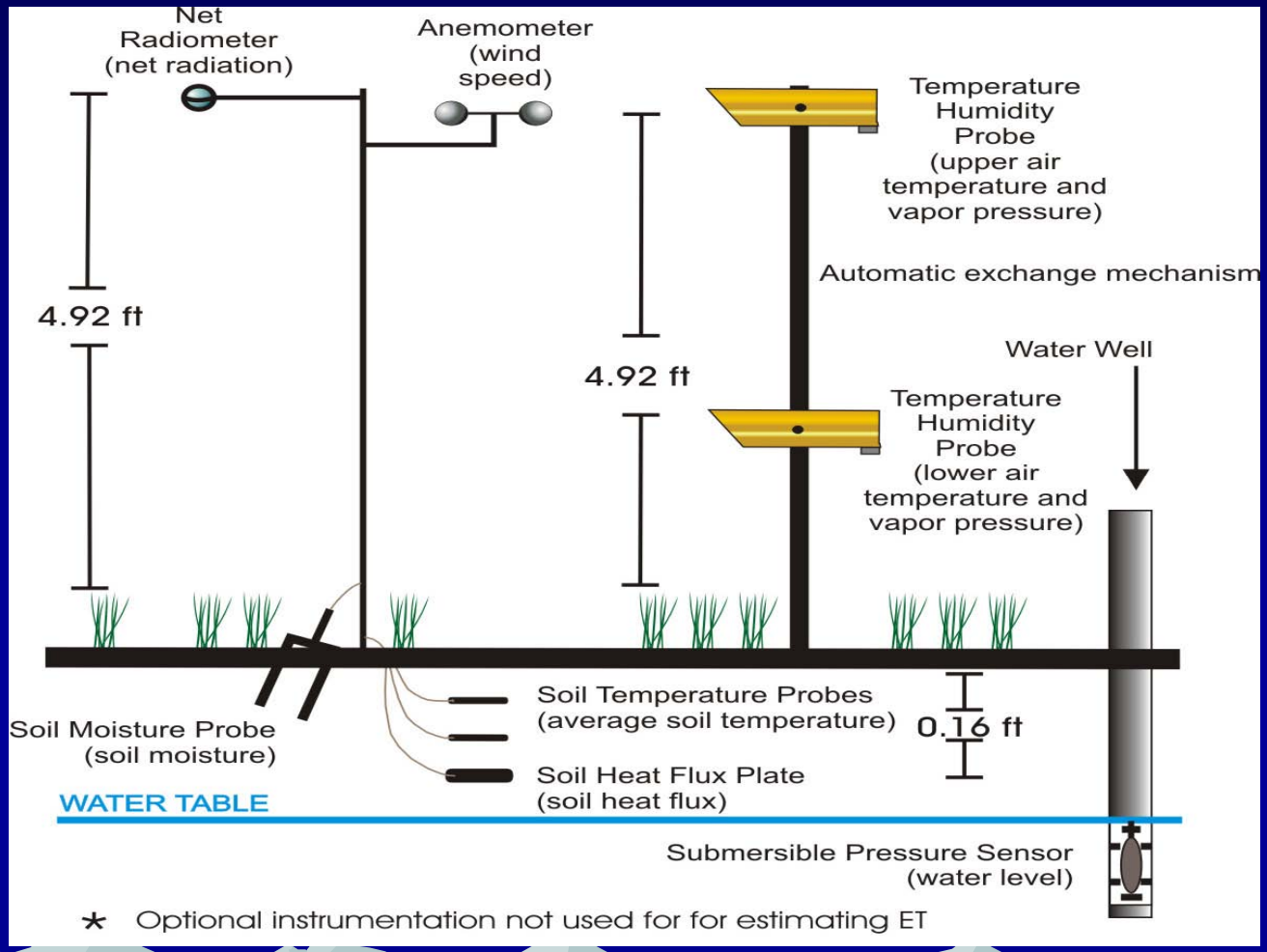
Discharge Task

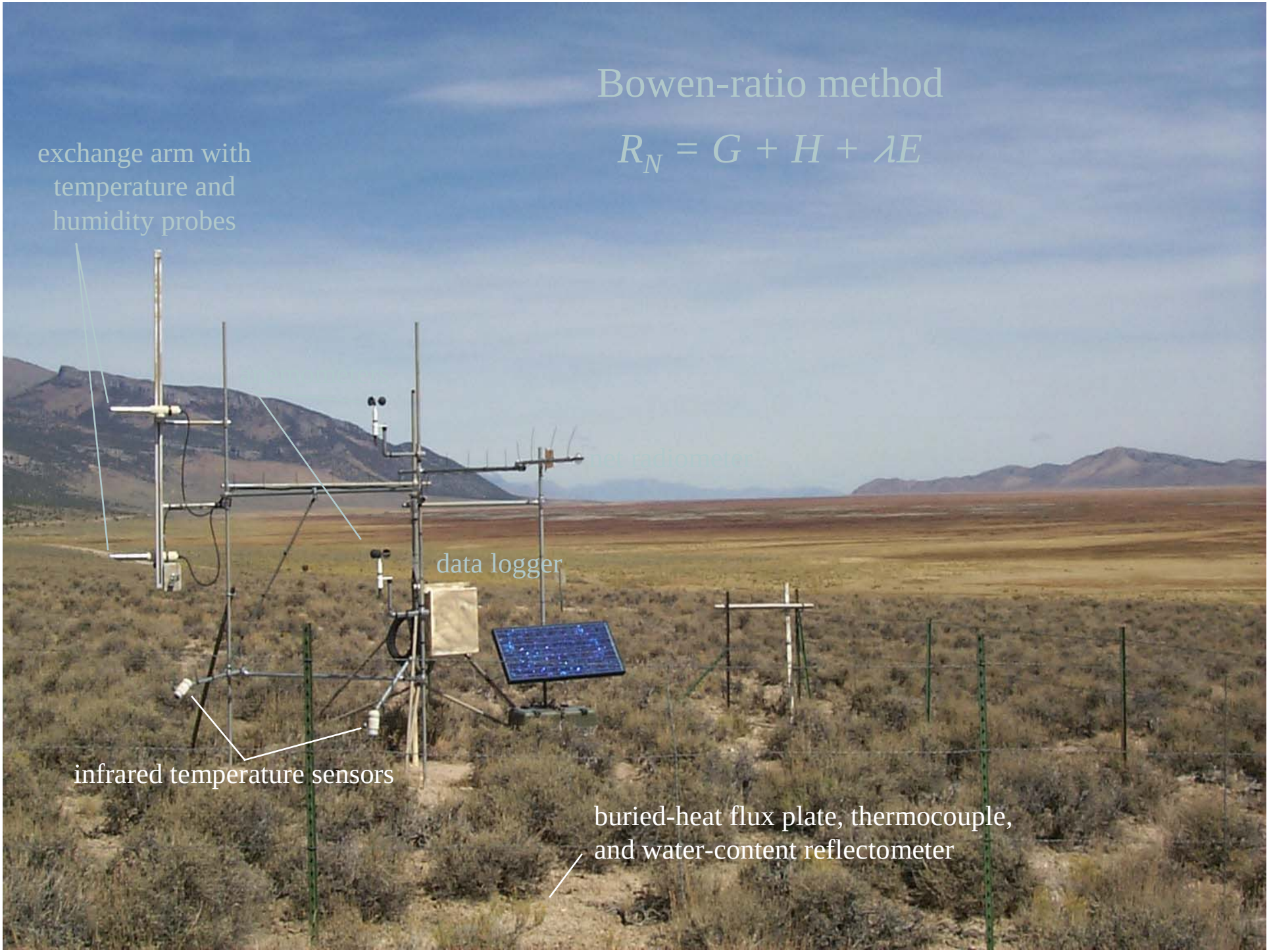
- Ground-Water Pumpage – Inventory; Need to determine consumptive use
- Spring Discharge - Local versus Regional Springs; used in conjunction with ET
- Evapotranspiration – From GW system, annualized

Evapotranspiration

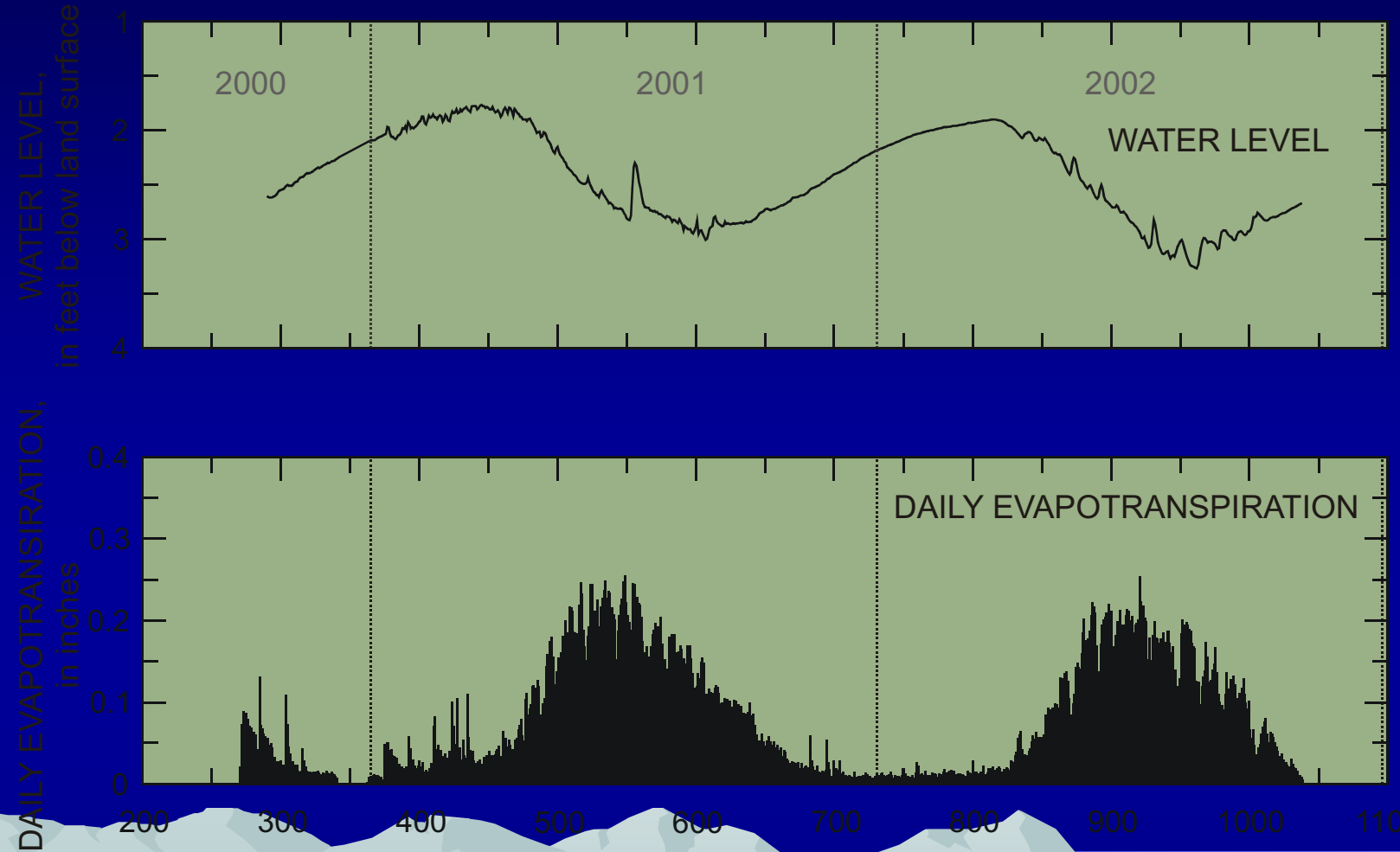
- Select Representative Vegetation Groups: Density and Type - Bins
- Collect Field ET Data – Dome and Micrometeorological Stations (BR or/and EC)
- Distribute ET over Areas of GW Discharge Using Remote Sensing Information

Evapotranspiration Analysis




Bowen-ratio method
$R_N = G + H + \lambda E$
exchange arm with temperature and humidity probes
data logger
infrared temperature sensors
buried-heat flux plate, thermocouple, and water-content reflectometer

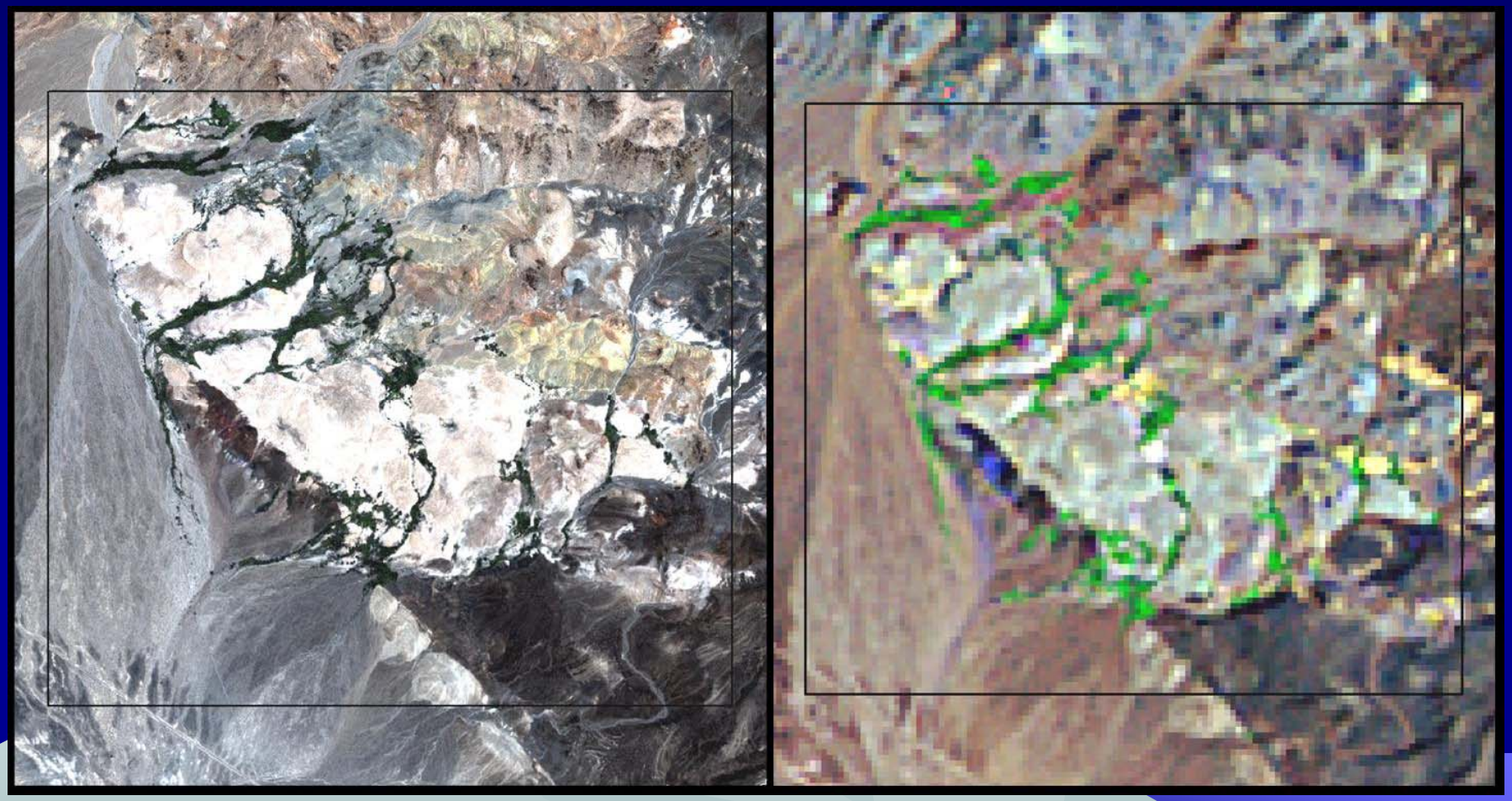
Evapotranspiration Analysis



Evapotranspiration Analysis

IKONOS 4.5 M

TM 30 M (LS7)



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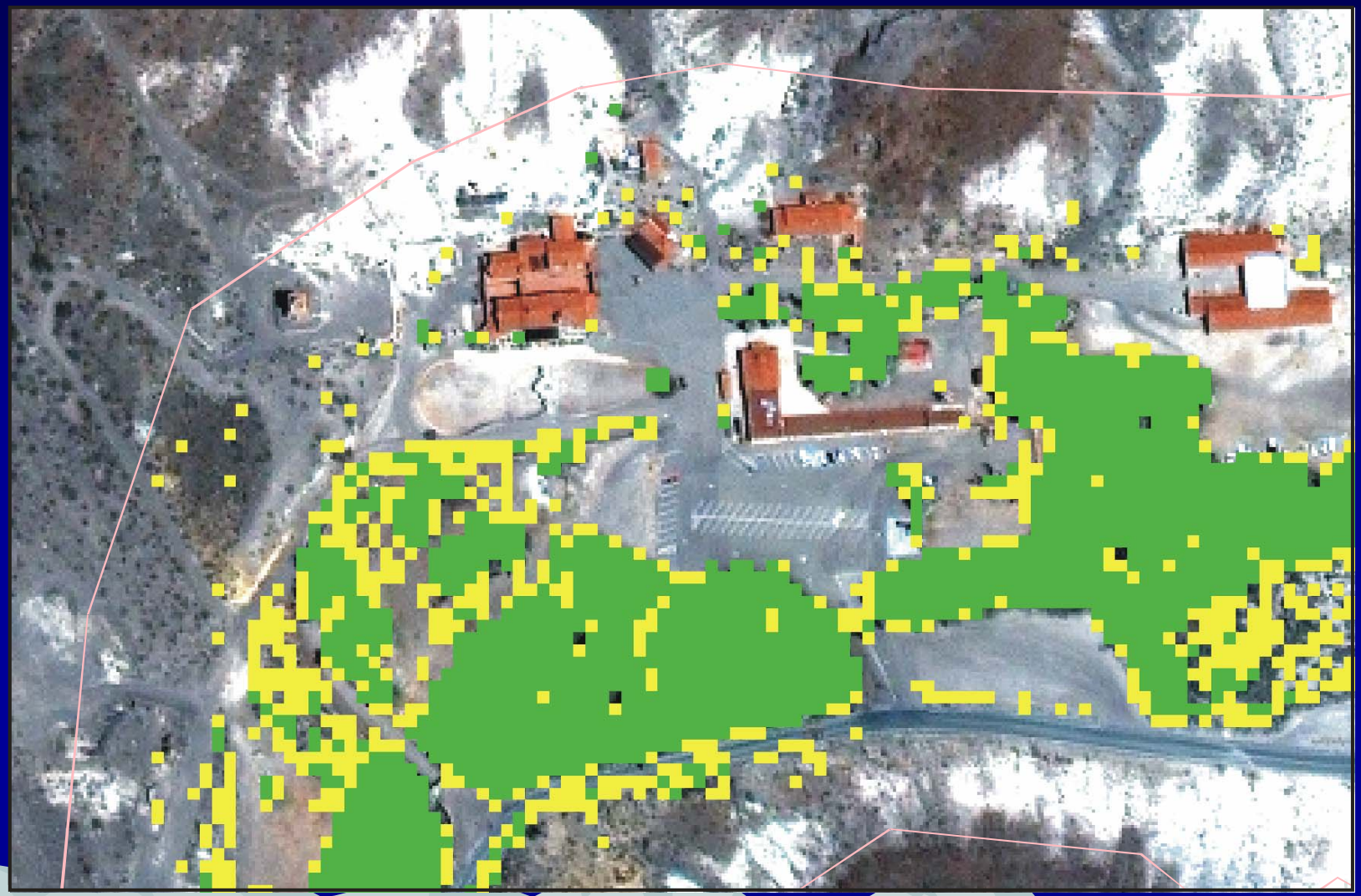

ET Research Needs

- Improved vegetation classifications schemes; edge effects
- Scaling between field measurement techniques (Dome, micromet), and coverage
- Scaling between remote sensing coverage's; 2 meter to 25 meter to 1 km
- Annualization of single scenes
- Larger scale measurement – Scintillometer; sensible heat flux only

Conceptual Model(s)

- Regional Potentiometric Map
- Basic Water Balance Model
- Geochemical Model (stable isotopes, age dating)
- MODFLOW (non-calibrated, used as data synthesis tool)